

possible, at facilities to have the most efficient service and space utilization.

6. Planning of all commercial facilities should reflect regional/commuter impacts and corporate/business general aviation needs. Minimizing the interaction between large and small aircraft using the same facilities increases facility design and operating efficiency.
7. Steps should be taken to incorporate more realistic design and separation criteria to effect a better utilization of existing and new facilities. In today's environment of high financing and capital costs, additional facilities are no longer the answer for flexibility. Better utilization of existing facilities must take on added importance.
8. Most importantly, all new facilities should address flexibility and changes of the current market. This includes incorporating flexibility and a response to change early in the design process, as the one consistent theme in the industry in the coming years, will be change.

INSUFFICIENT INFORMATION AND ANALYSIS:
AN OBSERVATION
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Introduction

Valuable data has been collected and useful analyses have been conducted concerning air traffic systems operations and technologies. This information provides measures of various aspects of airport and airspace capacity and delay and provides a basis for planning and developing system improvements. However, the capacity and delay information currently assembled does have room for improvement since the data do not in all cases accurately and completely quantify capacity and delay conditions and do not precisely identify all causes of congestion problems. Some analysis efforts are not tightly coordinated with other efforts and not integrated in regard to a consistent system-wide orientation. Analysis results are not always widely disseminated in a timely fashion.

The following paragraphs briefly comment on the cause and nature of various data deficiencies for the purpose of defining potential problems and issues. Detailed analysis of the areas of concern and recommendations for resolution actions are not addressed and would be subjects for in-depth research.

Performance Measures and Analysis Methods

Deficiencies in the current state of performance measures and analysis methods are due, in part, to divergent views concerning the basic analysis procedures. Analysis procedures range from empirical studies and mathematical equations to large-scale computer simulations. Performance measures range from hourly delay to annual capacity. This situation is healthy from the point of view that numerous alternative measures and techniques have been demonstrated, are available, and may be refined and tailored for selected system evaluation and design purposes. On the other hand, the use of different performance measures and analysis techniques may contribute to inconsistencies among

capacity and delay estimates, lost opportunities to complete a comprehensive data base, and lack of agreement on needed evaluation efforts.

The Airport Situation

Considerable effort has been concentrated on capacity and delay analysis because airport traffic handling capabilities are a dominant constraint on aviation operations. Alternative tools and techniques have been developed to quantify airport capacity and delay factors, and special site-specific study efforts have identified improvement programs for selected airports. However, apart from the site-specific individual airport study approach, uncertainties exist concerning the ability to identify, with a high degree of confidence, specific problem areas and system-wide solutions. Delay monitoring programs, for example, do not report similar and directly comparable data, cannot be considered precise, and are deficient in terms of reliably identifying sources of delay. Furthermore, capacity estimates are subject to question as demonstrated by practical annual capacity (PANCAP) calculations which are not consistent with actual traffic operations counts at various airports.

The Airspace Situation

Limited information has been assembled describing system-wide airspace capacity and delay factors and major efforts have not been devoted to establishing meaningful measures of airspace operating efficiency. In the case of en route airspace operations, where aircraft are subject to diversions from their preferred flight plan due to potential conflicts, control procedures, adverse weather and the like, delay is not necessarily the most significant measure of operating efficiency. For example, aircraft diverted to flight levels below their minimum fuel burn cruise level may experience significant fuel cost increases without experiencing delays. But, the degree to which aircraft currently are subject to excessive fuel burn and airspace delay conditions, the causes of those conditions, and future expectations are not well documented.

Information Integration

Evaluations of airport and airspace capacity and delay, of practical necessity, have focused mainly on specific topic areas rather than attempting comprehensively to integrate system-wide factors. For example, separate analyses have addressed airport capacity and delay, computer system capacity, air traffic control automation applications, controller human factors constraints, en route and terminal control procedures, controller productivity, and related topics. These studies have developed quantitative and qualitative information describing the various topics, but integration of the information has not been accomplished.

The deficiency in disseminating and integrating data is due in part to the specialized nature of each topic. Technical analysts tend to focus their attention on their area of expertise and develop very detailed knowledge concerning the topic. This information tends to reside with the specialists in each topic area, although specific information may be distributed through technical documentation and briefings. The situation arises in which persons active in airport and airspace systems operation and development may not have readily available and extensive data concerning technical areas outside their area of specialty and may not have a good

understanding of how their technical knowledge relates to that of other areas. Hence, there has been a limitation on the degree to which information in a topic area is used to enhance information in other topic areas. This lack of comprehensive information correlation and analysis has led to differences in the level of overall understanding of airport and airspace system operating conditions and development needs.

Summary Comment

Despite the extent of the analyses and data collections that have been accomplished, there is a concern that the capacity and delay information is insufficient in the sense that various data appear to be incomplete and semi-accurate. This situation results from data gaps, various degrees of lack of confidence in the accuracy of available performance measurements, a divergence of opinions on analysis methods, and a constrained flow of research information. This situation may prove to be particularly critical if it complicates efforts to develop consensus views on congestion problems and appropriate system improvements.

EFFECTS OF AIRPORT ACCESS/EGRESS AND LANDSIDE PROCESSING

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As described in Dr. Eisner's summary paper, "inefficient airport access/egress/processing" was ranked tenth (last) as a problem and action area by committee members. Although such inefficiencies are important landside issues, they were not considered critical to airfield and airspace capacity and delay problems and solutions by committee members.

In this paper, "inefficient airport access/egress/processing" is assumed to refer to inefficiencies in processing vehicles, people, baggage, and air freight in the airport landside elements such as the access roadways, curbside, parking facilities, and the passenger terminal building.

Inefficient access/egress/processing can be important to airside capacity and delay because it can result in:

- Underuse of airports in major metropolitan areas
- Deferral of needed airside improvements
- Competition for limited resources.

Underuse of Airports in Major Metropolitan Areas

Airport access/egress/processing may be a significant factor in determining which of several airports in a major metropolitan area air travelers choose to use. The access/egress time or distance to a particular airport may be perceived as a problem by air travelers and the airlines (whether or not it actually is a problem). Such perceptions probably explain at least in part why there are several major metropolitan areas where one airport (or airports) is saturated while another airport is underused.

Newark International Airport. For example, consider Newark International Airport, one of

three air carrier airports in the New York metropolitan area. The other two airports, John F. Kennedy International and La Guardia, probably have experienced the greatest air traffic congestion of any United States airports; Newark's capacity has been underused.

The Port Authority of New York and New Jersey, which operates all three airports, has attempted to encourage air travelers to make greater use of Newark so that Newark would accommodate a larger share of regional air traffic in the future. It has established programs for Newark that include improvements in ground access, public education, and creation of incentives for increasing service.

Dulles International Airport. In the Washington, D. C. area, many air travelers prefer to use Washington National Airport rather than Dulles International Airport because the distance to Dulles from downtown Washington is much greater, which partially explains why the airside at Washington National is saturated while Dulles airside capacity is underused.

Improvements are currently underway to reduce access/egress times to Dulles. For example, the extension of the Dulles access highway to Interstate Highway 66 is expected to reduce driving time between Dulles and downtown Washington, D.C., by about ten to twenty minutes, depending on the time of day.

Deferral of Needed Airside Improvements

Inefficient access/egress/processing is sometimes used to justify the deferral or rejection of needed airfield and airspace capacity improvements. For example, it might be judged that because an existing passenger terminal or access/egress roadway and parking system is congested, no airfield or airspace capacity improvements can be justified. Such improvements are sometimes believed to generate (or attract) more air traffic activity that, in turn, would further aggravate the landside congestion problem.

Although it is desirable to strive for a reasonable balance between airside and landside capacities and use, there are unique interactions between the airport airside and landside in terms of the consequences of congestion that must be considered. Congestion on the landside should not necessarily preclude the implementation of needed improvements in the airside (or vice versa).

In reality, congestion on the airside has much greater effect on landside capacity and delay than congestion on the landside has on airside capacity and delay. For example, delays to scheduled aircraft arrivals and departures caused by airside congestion can create major overloading and congestion in the landside facilities, particularly at the airport curbside.

Passengers have more flexibility in moving through the landside system than aircraft have in moving through the airside system, and the responses of passengers to congestion differ from the responses of aircraft operators. The "units" processed on the landside (e.g., passengers) do not operate according to a fixed time schedule or a strict set of rules and procedures such as those that apply to the movement of aircraft. If a particular landside process is known to be congested, passengers can adjust when they arrive at the airport to allow sufficient time for processing before they can board their flight with little or no effect on airside capacity.